

# Fluid Links for Informed and Incremental Hypertext Browsing

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## ABSTRACT

This paper and video present a novel user interface technique for hypertext, called *fluid links*, that has several advantages over current methods. Fluid links provide additional information at a link source, termed a *gloss*, to support readers in choosing among links and understanding the structure of a hypertext. Fluid links present glosses in a convenient location that does not obscure the content or layout of source material. The technique uses perceptually-based animation to provide a natural and lightweight feeling to readers. Fluid links provide a novel hypertext navigation paradigm that blurs the boundary between source and destination: computed glosses supply a “bring from” approach to hypertext, while multi-way links and nested glosses allow readers to skip through intermediate nodes while still attending to their original source context.

**KEYWORDS:** Fluid UI, fluid links, hypertext navigation, user interface, animation

## INTRODUCTION

Hypertext links pose three long-standing and well-known cognitive problems. First is the cognitive overhead associated with choosing whether or not to follow a link [4]. Second, the link rationale may be unclear, leading to additional cognitive disruption at the link destination as the reader tries to puzzle it out [7]. Finally, the steps involved in following links, determining their relevance, and returning to the source disrupt the reader’s attention and fragment the reading process [8]. Furnas has suggested that a link source should show a *scent* or *residue* of content that appears at the destination and beyond, to help readers find desired information [5]. Magel has also called for link anchors to provide visual clues about their destinations [9].

One solution to these problems is to associate explanatory material called a *gloss* with each link anchor. Glosses provide additional information about the link or its destination before the reader leaves the source context. Glosses help readers decide whether or not to follow a link. They thus reduce the disruption of following irrelevant links and prepare readers for understanding relevant ones.

Microsoft Internet Explorer 4.0 provides a version of this capability by combining the ToolTips user interface feature with the HTML “link title” feature [10]. If the reader’s mouse dwells over a link anchor, a small ToolTips window pops up that displays the contents of the anchor’s link title

field. The additional information is right at the anchor, and readers can access it in a very lightweight way. However, the pop-up window occludes some of the source text. Furthermore, the reader can’t interact with the contents of the pop-up window, because it vanishes as soon as the reader moves her mouse.

Fluid links provide a unique combination of features that enable lightweight, contextual, and animated access to glosses. Fluid links glosses appear near the link anchor without obscuring the source, and readers can access them via simple mouseovers. In addition, fluid links use animation to smooth the experience of viewing glosses and shift that experience from a cognitive to a perceptual activity – that is, not something readers have to think about consciously. Finally, fluid links enable improved gloss content and augmented hypertext navigation.

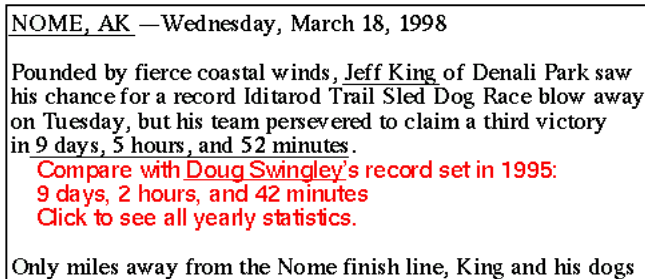


Figure 1. Fluid links: interline expansion. The expanded gloss (“Compare... statistics.”) contains a nested link.

## GRAPHICAL TECHNIQUES

We have explored a variety of animated graphical techniques for displaying glosses: interline expansion, margin callout, textual overlay, and small textual cues.

The interline expansion technique, shown in Figure 1, works by gradually shrinking the interline spacing of the text as the gloss grows to readable size. Shrinking the interline spacing over the length of an entire page allows many lines of gloss to be accommodated while retaining full readability of the source material. The advantages of this technique are that the gloss is adjacent to the anchor, so the reader’s eyes needn’t move, and the source is not occluded. A minor disadvantage is that the source shifts slightly. However, the animation allows the reader to perceive the shift correctly as a movement of the original material, rather than as a potentially mysterious change.

In the textual overlay technique, the source text gradually fades in color around the gloss to allow the gloss to grow to readable size over top of it. The faded text is still at least partly visible. As in interline expansion, the gloss is adjacent, but this time the source does not shift. However, the source is partly occluded.

In the margin callout technique, a small line grows out from the anchor toward the nearest margin and then expands to show the gloss. The advantage is that the source material can remain completely constant as the callout line travels through it. The disadvantage is that the gloss is distant from the anchor. Again, the animation mitigates this flaw. As a gloss opens, the moving callout line guides the reader's eyes toward the gloss. As it closes, the callout line reverses the animation to guide the eyes back to their original reading location.

The three techniques for placing glosses discussed above all indicate the presence of a gloss in the same way, with an underline. Prompted by the availability of some new Xerox displays that approach the resolution of paper, at 282 dots per inch, we've also tried using small text as a visual cue. For example, 3 or 4 point text is quite readable on these displays. This tiny text provides another level of gloss at a glance. Furthermore, we can combine the small cue with any of the techniques for placing glosses.

#### **HYPertext CONTENT AND NAVIGATION**

Simple glosses are explicitly authored for a particular link site. In fact, this is the only kind of gloss provided by previous systems. Simple glosses can describe the destination to help readers decide whether or not to follow the link, or explain the relationship between the source and destination to help readers interpret the destination and its relevance more quickly.

Fluid links also support glosses that are computed dynamically. Their contents can be automatically derived from their destination, such as the title or first sentence. As a result, their contents never become out-of-date when the destination content changes. Computed glosses can also show meta-information about the link or its destination, such as the author, creation date and number of accesses.

In addition, fluid links enable augmented navigation capabilities. Glosses can contain links, and can thus act as multi-way links. This provides a smoother mechanism than either an intermediate link page or a pop-up interaction box. Glosses can also be nested. Nested glosses allow the reader to drill down through several nodes of hypertext in order to jump to a deeply nested destination, without incurring the overhead of changing context at each stage.

The videotape shows two prototype versions of fluid links. The first version supports interline expansion and textual overlay. It is written using the Pad++ environment with a Python front-end and is shown running on a Sun Ultra 1 computer. The primary Pad++ metaphor is animated zooming [1,2]. We use their scaling and animation primitives in the opposite way, to scale the glosses smoothly rather than to zoom the entire view. The second version supports small textual cues and margin callout. It is

written in C++ for better performance on the high-resolution display, and is shown on a Pentium 166 PC.

We have recently implemented a negotiation architecture, written in Java, which allows us to codify the negotiation between the primary and supporting material and even to combine multiple graphical techniques to show a single gloss [3]. We have also used a related approach to improve the user interface for spreadsheets [6]. A more detailed description of fluid links can be found in [11].

#### **CONCLUSION**

Fluid links enable lightweight, contextual, and animated access to additional information about a link or its destination. We have explored a variety of graphical techniques that can be useful in different settings or even in combination.

We believe that fluid links help readers increase their engagement with source material by reducing the cognitive overhead associated with choosing links, and by reducing the disruption of following links.

Fluid links blur the boundary between the source and the destination. Computed glosses provide a "bring from" approach to hypertext links that may support readers better than the traditional "go to" approach. Multi-way links and nested glosses allow readers to skip through intermediate nodes while still attending to their original source frame of reference. These new interactions promise a smoother hypertext experience for readers.

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